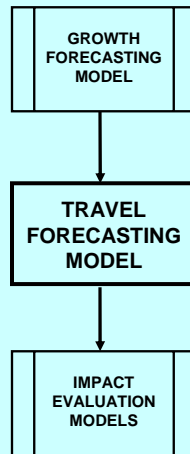

Welcome to the Third Model Peer Review

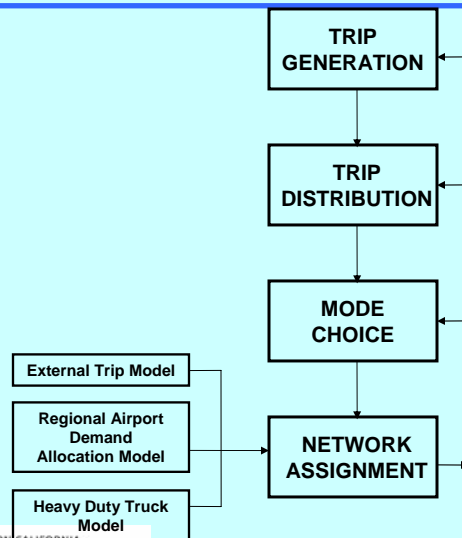
January 9, 2006

Update on ISD-Modeling

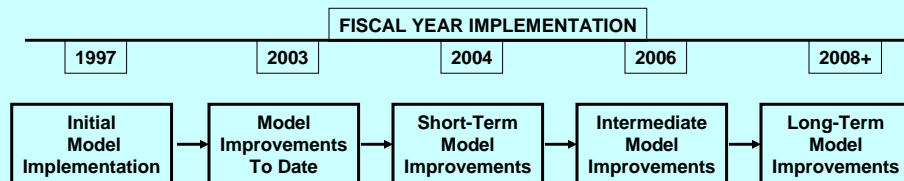
Regional Transportation Plan Modeling Process



Travel Forecasting Structure



Model Improvement Timeline



Model Estimation Data

- Year 2000 Post Census Regional Travel Survey
- Transit On-Board Origin-Destination Surveys
- Regional Cordon Survey
- Street/Highway Inventory Survey
- Arterial Speed Study
- Regional Screenline Study
- LADOT Street Inventory Survey
- Trucking Firm Origin-Destination Survey (current)
- High-Speed Rail Stated Preference Survey (current w/ MTC)

Travel Model Improvement Project

■ Improved Policy Sensitivity

- Refined Behavioral Characteristics
- North American Industrial Classification Standard Employment
- Demographics
 - Household Income
 - Household Size
 - Vehicle Availability
 - Number employed
 - Number of Students

■ Increased Network Simulation Accuracy

- Refined Highway & Transit Network Characteristics
- Capacity Restraint Volume-Delay Functions
- Separate Peak & Off-peak Highway Networks
- Multi-class Vehicle Network Assignment
- Highway Network Equilibrium Convergence



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Modeling Improvements

■ Intermediate (FY05 – FY06)

- 2003 Model Validation & Sensitivity Analyses
- Personal Computer Modeling Platform (TransCad, Cube, Visum)
- GIS-based Highway Network Representation
- Heavy Duty Truck Model
- Alternatives Analysis MagLev Model
- Systems Analysis Enhancements (measures, subarea, sketch)

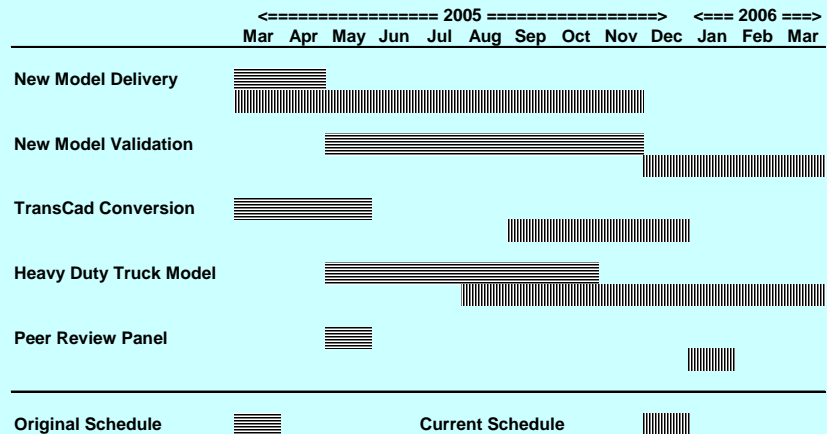
■ Long Term (FY07 & beyond)

- Incorporate SanDAG region at a superzone level
- Integrated Transportation/Land Use Model
- Demand Microsimulation (Activity-based Model)
- Web-based Modeling Capability
- Network Microsimulation (Traffic Modeling)



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Model Improvement Schedule



Model Validation Comparisons

- Year 2000 Post Census Regional Travel Survey
- Transit On-board Origin-Destination Surveys
- 2000 Census Transportation Planning Package
- Highway Vehicle Ground Counts (PeMS & ATSAC)
 - Regional Screenline Survey
 - Regional Cordon Survey
 - LADOT Downtown Cordon Survey
- Transit Boarding Counts (Bus, Urban & Commuter Rail)
- Highway Performance Monitoring System (HPMS)
- Trucking Firm Origin-Destination Survey (current)

Interim Model Improvements – Feb 06

- **New Socio-Economic Data Forecasts**
- **Revised Trip Generation Model**
- **Revised Network Assignment Procedures**
 - Peak period highway capacity
 - New volume-delay functions
- **Revised Truck Data**
 - External cordon data
 - Port complex trip distribution



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Volume Delay Curves

- **Akcelik functions for freeways and arterials**
- **Function forms and parameters were proposed by Richard Dowling of Dowling Associates**
- **Based on results from SCAG Arterial Speed Study Project in 2004**



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Akcelik Equations

- For Freeways (Akcelik 1, J=8, c=0.775)

$$S = \frac{L}{\frac{L}{S_0} + 0.25 \left[cx - 1 + \sqrt{(cx - 1)^2 + \frac{8Jc^2x}{\text{cap}}} \right]}$$

- For Arterials (Akcelik 2, a=0.0025, c=0.5273)

$$S = L / [L / S_0 + 0.25 \{ (cx - 1) + \{ (cx - 1)^2 + 16acx \}^{1/2} \}]$$

S = predicted speed (mph)

S₀ = free flow speed (mph)

L = link length (miles)

x = volume/capacity ratio



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Arterial Speed Study Research Objectives

- Determine the speed-flow curves for predicting signalized arterial street speeds
- Develop a cost-efficient method for gathering speed data for the various levels of arterials throughout the SCAG Region that can be used for model validation purposes and potential congestion monitoring uses
- Determine the number of samples necessary to validate the Regional Model's output speeds



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Arterial Speed Study Research Objectives continued

- Conduct a pilot survey to demonstrate the practicality of the methodology and begin building the Regional speed database
- Develop a program that will continually gather speed measurements to update the Regional Arterial Speed Database and monitor speed changes over time

Data Collection

■ 8 sites in the City of Los Angeles:

- principal and minor arterials
- 15k to 55k ADT
- 4-6 lanes
- 2-10 signals/mile



Data Summary

■ Data Collected

- 54 directional segments between signals
- 4 hours of observation in each direction
- 216 hourly observations (volume and speed)
- v/c range: 0.1 to 0.99
- speed range: 4 to 41 mph

- Volume: Signalized intersection turn counts at 15-minute intervals

- Speed: GPS equipped floating cars at 3-10 samples per hour



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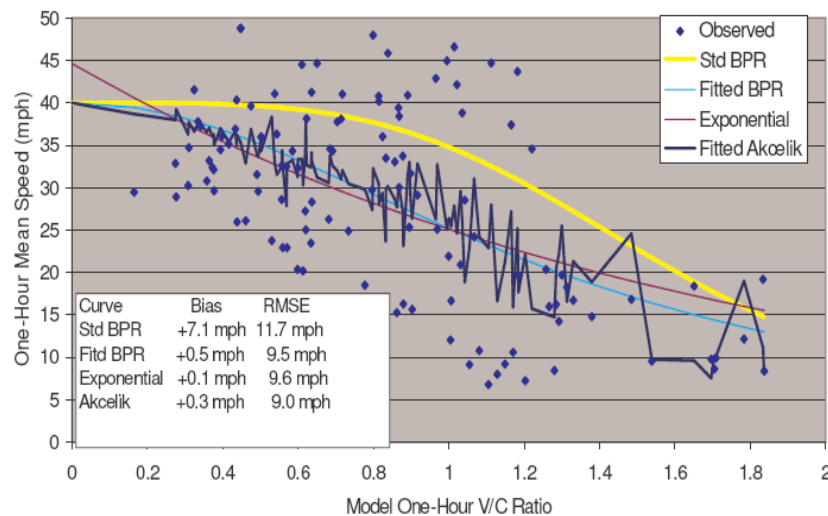
Functional Form Candidates for Speed-Flow Curves

Functional Form	Example	Comments
Linear	$y = -a x + b$	Not acceptable. Zero speed at high v/c.
Logarithmic	$y = -a \ln x + b$	Not acceptable. No value at $x = 0$
Exponential	$y = a s_0 \exp(-bx)$	Has all required traits for equilibrium assignment.
Power	$y = a / x^b$	Not acceptable. Infinity at v/c = $x = 0$.
Polynomial	$y = -ax^2 - bx + c$	Not acceptable. Zero speed at high v/c.
BPR	$y = s_0 / (1 + a (cx)^b)$ Has all required traits for equilibrium assignment.	
Akcelik	$y = L / [L / S_0 + 0.25 \{ (cx - 1) + \{ (cx - 1)^2 + 16acx \}^{1/2} \}]$ Has all required traits for equilibrium assignment.	



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Speed-Flow Curve Alternatives Versus One-Hour Field Data



Full Model Validation

1. Check the accuracy of the model inputs
2. Check the accuracy of the model outputs
3. Conduct the sensitivity analysis

Model Inputs

- **Socio-economic & Parameter Data**
 1. Population
 2. Employment
 3. Housing units
 4. Market segmentation (household income)
 5. Auto operating cost

- **Highway Network**

- **Transit Network**



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Highway Network

1. Review by county transportation commissions
2. Check number of lanes & access connections
3. Append roadway gradients to the network
4. Review Free Flow Speed and Capacity
5. Review truck passenger car equivalents
6. Add more screenlines



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Transit Network

- 1. Collect transit fare and boarding by modes**
- 2. Compare data to Transtar Transit Itinerary database**
- 3. Check actual transit travel time against network-estimated travel time**
- 4. Load buses on the highway network**



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Collect Counts

- 1. Counts on the screenlines**
- 2. Counts on the freeways, HOV lanes**
- 3. Counts in the ATSAC database**
- 4. Counts from sub-regional models inputs**
- 5. HPMS VMT by county and air basins**



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Model Outputs

1. Trip Generation
2. Trip Distribution
3. Mode Choice
4. Highway Assignment
5. Transit Assignment



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Trip Generation

- Check trips against the O-D survey (per household, per capita, per worker, etc.)
- Check % of trips for each trip type against the O-D survey
- Check vehicle availability against the O-D survey.



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Trip Distribution

- **Compare trip length frequency distributions by purpose and market segment**
- **Review the % flows of trips by County, Regional Statistical Area (RSA), and Community Statistical Area (CSA) against the CTPP data and O-D survey**

Mode Choice

- **Check trip end (production & attraction) % of trips by mode against the O-D survey**
- **Check trip end % of trips by mode by Regional Statistical Area (RSA) against the O-D survey and CTPP**

Highway Assignment

- **Make VMT comparisons with the HPMS database by air basin and county**
- **Compare absolute and percent volume difference by assignment group and mode against the screenlines**
- **Compare absolute, average, and percent error; standard deviation; R^2 ; Root Mean Square Error; and, correlation coefficient between model volumes and count volumes:**
 - Screenlines
 - Volume Groups
 - Facility Type
 - Regional Statistical Area
- **Compare assigned volumes against the Downtown Cordon Count Report**
- **Check absolute and percent speed difference to PeMS and ATSAC database**



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Transit Assignment

- **Boarding counts by company and mode between model outputs and estimates from the transit operators:**
 - Bus ridership by company
 - Individual urban and commuter rail line ridership
- **Boarding counts against the Downtown Cordon Count Report**



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Sensitivity Analysis

- **Review the Base Year emission inventory**
- **Use new and old socio-economic data as inputs to evaluate the changes in emissions due to SED change**
- **Use new and old networks to evaluate the changes in emissions due to network change**
- **Use new and old models to evaluate the changes in emissions due to model change**



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Sensitivity Analysis continued

- **Run the existing model using both Tranplan and Transcad to evaluate the changes in emissions due to software change**
- **Run the new model using the old zones to evaluate the impacts of zone change**
- **Run 2010 Baseline and Plan to evaluate the sensitivity of the full model stream**



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Current Model Improvement Projects

- 2003 Model Validation & Sensitivity Analyses
- Personal Computer Modeling Platform
- GIS-based Highway Network Representation
- Heavy Duty Truck Model
- Alternatives Analysis MagLev Model

Data Collection Enhancements

- Conduct Highway Inventory Survey
- Conduct Parking Cost Survey
- Collect ATSAC and PeMs database
- Prepare next Regional Travel Survey
- Develop Model Master Network Database
- Link MTA's Trip Master Transit Itinerary Database
- Improve HPMS database

Future Model Improvements

- Develop Sketch Plan Model
- Incorporate SanDAG region at a superzone level
- Integrated Transportation/Land Use Model
- Demand Microsimulation (Activity-based Model)
- Web-based Modeling Capability
- Network Microsimulation (Traffic Modeling)

